

**REMARKS**

Claims 1-32 are all the claims pending in the application.

As a preliminary matter, the drawings are objected to under 37 C.F.R. § 1.83(a).

Applicant submits that the light modulation device of claim 8 is shown in the drawings. For example, a light modulation device is shown in Fig. 25, as AOM 100 and an oscillator 103, and described on page 43, lines 2-4 of the Specification.

Claim 8 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite and as being incomplete. Although the Examiner states that “[t]he omitted structural cooperative relationships are: a light modulation device with the wavelength conversion module,” (Office Action, page 4, 1<sup>st</sup> paragraph) Applicant submits that there is sufficient recitation of structural cooperative relationship of the light modulation device as an element of the light wavelength conversion module. Claim 8 necessarily implies a structural relationship between the light modulation device and the light wavelength conversion element because the claim recites “a light modulation device and an optical system which separates a wavelength-modulated wave from the laser beam which has exited from said light wavelength conversion element.”

Claims 1-32 are pending in the application. Claims 1-3, 5-24 are rejected under 35 U.S.C. § 102(b) as being anticipated by Sonoda (JP10254001) (“Sonoda”). Claims 4, 25-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sonoda in view of Nagai et al (U.S. Patent No. 5,617,435) (“Nagai”). Claims 29-32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sonoda as applied to claims 1, 12, and 22, and in view of Harada (U.S. Patent

RESPONSE UNDER 37 C.F.R. § 1.116  
U. S. Application No. 09/517,589

No. 5,415,743) ("Harada"). Applicant submits the following arguments to traverse the prior art rejections.

Applicant's invention relates to a light wavelength conversion module. Applicant refers the Examiner to the description of the Applicants' invention and the cited reference in the 4 February, 2003 Amendment under 37 C.F.R. § 1.111.

I. Rejection of claims 1-3, 5-24 under § 102(b)

Applicant submits that claim 1 is patentable because Sonoda fails to anticipate each and every element of the claim. Specifically, claim 1 recites a light wavelength conversion module comprising a light wavelength conversion element formed of a bulk-shaped wavelength conversion crystal. Applicant reemphasizes that Sonoda fails to disclose a "bulk-shaped wavelength conversion crystal" and merely discloses a light wavelength conversion element 15.

Applicant also submits that a light wavelength conversion element formed of a bulk-shaped wavelength conversion crystal is distinct from a light wavelength element 15 having a channel optical waveguide 18, as disclosed in Sonoda. "Bulk," as recited in claim 1, is a term of art used for materials with distinct properties. For example, in the reference cited by the Examiner in the § 103(a) rejection below, Nagai, "bulk materials" were conventionally described as having a refractive index which fail to meet a second-harmonic light generation requirement (col. 1, lines 27-37) in a semiconductor laser system. On the other hand, a "wavelength-conversion waveguide" is described as meeting a second-harmonic propagation constant requirement (col. 1, lines 43-47). Furthermore, Applicant submits an attachment which provides an example of industry usage which shows that a bulk device, i.e., a "bulk-shape wavelength

conversion crystal” is distinct from and a waveguide device, as described in Attachment I.<sup>1</sup> In particular, even *assuming arguendo*, that Sonoda includes a crystal structure, it need not include a bulk-shaped structure. Attachment I contemplates that waveguides can accrue efficiency without a bulk structure and that bulk structures conventionally detract from conversion efficiency. Therefore, contrary to the Examiner’s interpretation, the optical channel of Sonoda does not inherently have a bulk structure and teachings of the art tend to teach away from a bulk structure for wavelength conversion.<sup>2</sup> Applicant was the first to recognize the applicability of bulk structures for sufficient conversion effects.

Claims 10-13, 15, 18, 21-24, which depend from claim 1, are patentable for the reasons submitted above for claim 1.

Alternatively, or in addition, claim 13 is patentable because the Examiner has failed to show that Sonoda discloses a light wavelength conversion module wherein the narrow band-pass filter is a birefringent filter.

Alternatively, or in addition, claim 23 is patentable because the Examiner has not shown that Sonoda discloses a light wavelength conversion module wherein a semiconductor laser is a high power semiconductor laser which has an output power of 300 mW or more.

Independent claims 2, 3, 5-7, 9, 19, and 20 are patentable for reasons similar to those submitted above for claim 1. Dependent claims 4, 8, 14, 16, and 17 are patentable for at least the reasons submitted for their respective base claims.

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<sup>1</sup> See <http://www.hcphotonics.com/waveguide.htm>.

<sup>2</sup> See Attachment I and Nagai, col. 1, lines 27-37.

RESPONSE UNDER 37 C.F.R. § 1.116  
U. S. Application No. 09/517,589

Alternatively, or in addition, claims 19 and 20 are patentable because the Examiner has failed to show a semiconductor laser coupled to an end surface of a light wavelength conversion element, and a transmission type thin film narrow band-pass filter disposed between a light emitting surface of said semiconductor laser and an end surface of said light wavelength conversion element. Applicant requests the Examiner to show where a transmission type thin film narrow band-pass filter as recited in the claims is disclosed in Sonoda.

II. Rejection of claims 4, 25-28 under §103(a)

Applicant submits that claim 4, which depends from claim 3, is patentable for the reasons similar to those presented above for claim 1. The Examiner has not shown how the combination of Sonoda and Nagai makes up for the deficiencies of Sonoda with regard to a “bulk-shaped wavelength conversion crystal” in combination with other elements of the claim, to render claim 3 obvious.

Claims 25-27, which depend from claim 1, are patentable for at least the reasons submitted for claim 1. Further, the combination of Sonoda and Nagai fails to make up for the elements of claim 1 which are lacking in Sonoda.

Alternatively, or in addition, Applicant requests the Examiner to provide prior art that substantiates the claim that a light modulation device for modulating the intensity of the laser beam which has exited from said light wavelength conversion element, by changing a driving current of said semiconductor laser to modulate the intensity of the fundamental wave emitted from said semiconductor laser, in a combination with other elements, is notoriously well known in the laser art to render claim 26 obvious.

RESPONSE UNDER 37 C.F.R. § 1.116  
U. S. Application No. 09/517,589

Claim 28 is patentable for reasons similar to those submitted above for claim 1 because the combination of Sonoda and Nagai fails to make up for the deficiencies of Sonoda with respect to claim 28.

Alternatively, or in addition, claim 28 is patentable because the Examiner has not addressed how the light scanning and recording apparatus comprising a scanning device in combination with other elements of claim 28 is obvious with respect to the cited references. The scanning device as recited in claim 28 is a feature that is not taught or suggested in Sonoda or Nagai or both. Also, claim 28 does not merely recite an intended use, but recites structural features such as a “scanning device.”

Alternatively, or in addition, Applicant submits that the Examiner has improperly combined the references because the Examiner has failed to put forth a valid motivation to combine the teachings of Sonoda and Nagai. As submitted by the Applicants in the February 4, 2003 Amendment, only the TE mode is propagated in Sonoda, while only the TM mode is propagated in Nagai. In Nagai, “the semiconductor laser 10 is arranged so that the direction of polarization of the emitted semiconductor laser light in TM mode agrees with the direction of TM mode of the waveguide 14 (col. 7, lines 61-65). Due to the different modes of propagation, one skilled in the art would not be motivated to combine the modulation as taught by Nagai with the laser wavelength converting module of Sonoda. Therefore, regardless of the reason why Nagai was cited, the reference cannot be combined with Nagai due to these fundamental differences in operation.

III. Rejection of claims 29-32 under § 103(a)

Harada relates to an optical wavelength converter element having periodic domain reversals. Applicant submits that claims 29-32 are patentable because the Examiner has not established a *prima facie* case of obviousness.

Although the Examiner cites Harada as disclosing a wavelength conversion element having periodic domains penetrating from one surface to another, Applicant submits that Harada's disclosure of the bulk-shaped wavelength converter teaches away from what is recited in claim 1. Harada discloses conventional means for improving the typically low wavelength conversion efficiency of a bulk-shaped wavelength conversion crystal by placing the bulk-shaped wavelength conversion crystal within a resonator structure (col. 11, lines 10-13; FIG. 6). To the contrary, there is nothing in Harada, or in any of the references cited by the Examiner, which suggests the use of a bulk-shaped wavelength conversion crystal that is not within a resonator structure. In contrast, the invention as claimed inherently discloses wavelength conversion by "direction conversion" in which the wavelength conversion does not take place within a resonator structure. Therefore, one skilled in the art would not be motivated to modify the light wavelength conversion element 15 of Sonoda with the bulk-shaped wavelength conversion crystal taught by Harada.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

RESPONSE UNDER 37 C.F.R. § 1.116  
U. S. Application No. 09/517,589

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.


Respectfully submitted,

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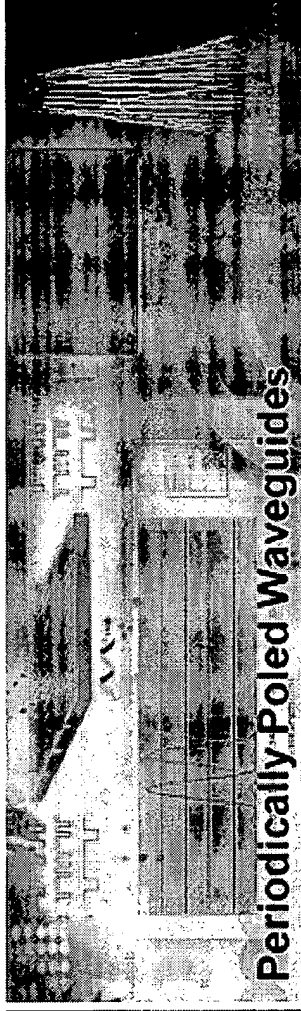
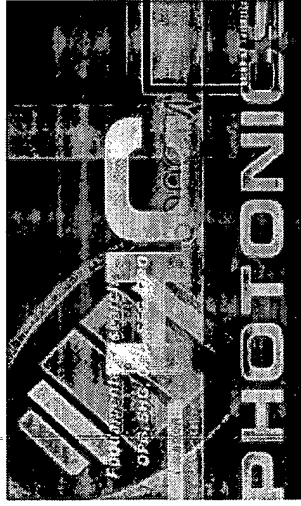
Date: October 28, 2003

## ATTACHMENT I

**HCP**  
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Periodically Poled Waveguides

- ▶ Periodically Poled Bulk Device
- ▶ Periodically Poled Waveguide
- ▶ Optical Thin-Film Coating & Polishing
- ▶ Optics and Crystals
- ▶ Lasers
- ▶ Oven & Temp Controller
- ▶ IR sensor cards & Accessories
- ▶ Opto-mechanics

### Technology (PPLN Waveguide, PP-MgO:LN Waveguide)

Periodically poled waveguides can further enhance nonlinear mixing efficiency as compare to bulk media, by tightly confining optical field over long distances. The tightly focused wave will often diffract when it propagates in a bulk device, so high conversion efficiency cannot be achieved. In waveguides, the mode profile is confined to a transverse dimension on the order of the wavelength, then high optical intensities can be maintained over considerable distance to improve the conversion efficiency by two to three orders of magnitude as compare to bulk devices. Also, the nonlinear mixing efficiency is quadratically proportional to the interaction length of the waveguide device, thus the fabrication of long, uniform and low loss waveguide is essential for high efficiency optical frequency mixer.

### All-Optical Signal Processing

HC Photonics introduces the first commercially available PPLN (Periodically Poled Lithium Niobate) waveguide in the market. PPLN waveguide can be used for the development of optical frequency (OF) mixers in which is well suited for optical fiber communication and other all-optical signal processing applications. Such optical frequency mixer is considered as enabling technology to realize high capacity and transparency in WDM and in high-speed TDM systems. Several potential OF mixer devices in which based upon the quasi-phase-